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Transformation and the Defense Industrial Base: A New Model

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Overview

American force transformation is about building a new expeditionary model with flexible, modular forces that can be managed on a global basis to protect U.S. interests. Breaking the tyranny of geography on military forces is a key aspect to change.

Transformation represents a shift in the demand side of the defense industrial business to provide for these new capabilities. The Department of Defense (DOD) is seeking system-of-systems management to deliver capabilities to the services and for joint military operations. This represents a shift from the past emphasis upon platforms and a primary focus upon service-specific technologies and programs.

As the demand side of the equation has shifted, so has the supply side. Defense consolidation in the 1990s dealt with scarcity; now the newly emerged mega-primes are asked to play the role of lead systems integrators (LSIs) or system-of-systems managers to deliver capability to DOD for transformed operations.

DOD moved to a different way of doing business before the transformation effort emerged as a core priority. Now that the transformation agenda is dominating the shift in the relationship between industry and government, working through LSI roles in shaping capabilities-based procurement will be especially important.

Additionally, the new LSI and system-of-systems management model is shaping a new approach to allies. The new model can allow industry to shape new capabilities on a transatlantic basis. Rather than the old export-after-production model, the new LSI model, coupled with a transformation emphasis, leads to the shaping of new opportunities for developing capabilities before core series production decisions would be taken.

Transformation Drives Models

The United States is moving from an older model of forces directed by service chiefs to a more flexible model in which systems operate interactively to provide global capabilities for U.S. intervention. The process of building a new model for U.S. forces is being forged with several key building blocks. The synergy among these building blocks is crucial in building a net-enabled force to operate globally. The shift is from platforms serving single-service roles to systems of systems that deliver capabilities in support of joint and combined forces operations worldwide.

Transformation is focusing upon where joint forces and global capability are expected to be 20 years from now and working back to the present. This represents a significant shift in how the Department of Defense (DOD) would like to shape its industrial base.

At the heart of the transformation effort is a key focus upon an ability to fuse data and deliver common operational pictures to the forces.[1] To do so will require a shift in the DOD acquisition approach. One idea is to increase the role for Joint Forces Command and emphasize the role of combatant commanders in acquiring fusion technologies.[2]

Building Blocks for the New Global Expeditionary Model

- Crisis management and antiterrorism efforts
- Development of global logistics support
- Development of global information technology capabilities
- Global "weaponization" or the ability to resupply worldwide with a coalition of U.S. and allied defense industrial firms and depots
- Interoperability across U.S. forces, allies, and coalition partners
- Plug-and-play forces for strategic insertion on a global basis
- Space-enablers for joint forces
- Intelligence, surveillance, and reconnaissance focused primarily on supporting the warfighter
- Active defense to protect the insertion of forces
- Strategic mobility to support the movement of Army and Marine Corps forces
- Expeditionary mindset and focus

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Equipment priorities in the transformation approach are not placed on service-specific equipment choices. Rather, they are placed on those capabilities that can emerge from multiservice needs and requirements. In other words, DOD will want industry to deliver equipment and systems that allow for enhanced modularity, global management capabilities, and new approaches and technologies that are most beneficial to the widest range of operations.

Finally, technology that reduces manpower and allows for breakthroughs in life-cycle support costs is favored. Total cost of ownership is a key principle in favor of choosing weapon systems and capabilities. Rather than prioritizing the most advanced platform or subsystems, DOD is looking to the strength of the overall system of combat to provide superiority. Within this calculus, individual parts of the system need to be cost-effective from a life-cycle support perspective.

In short, central to the new transformation approach is a shift in the demand that DOD is placing upon its defense industrial base. A capabilities-based procurement requires lead systems integrators (LSIs) and system-of-systems managers to work with DOD to deliver broad-based families of systems.

A New Model

The consolidation of the defense industry over the past decade has been a response to the downsizing of Western defense budgets. Consolidation was a necessity due to reduced demand for equipment in the procurement pipeline. Military forces were being downsized and redesigned for new peacekeeping missions and reduced threats from traditional adversaries.

The result of the defense restructuring process of the late 20th century has been to put in place a small number of mega-primes that can provide comprehensive systems integration and management capabilities at the disposal of the U.S. Government. This process was put in motion to deal with declining markets and scarcity; now the challenge is to make good use of the new situation to enhance U.S. and allied security.

Before the Bush administration came to power and before September 11, a new consolidated industry had emerged to deal with and manage reduced demand. That industry must respond to a different set of circumstances. A dramatic increase in defense and security spending provides a near-term opportunity for industry; the shift to a different focus—transformation—provides uncertainty about how that industry will be redesigned to work with the new demands of the Federal Government.

At the core of the new effort is a new relationship between Government and industry in building systems architectures. An industrial prime works with the Government in shaping requirements and approaches for building a system of systems, or a group of system capabilities, that needs to be networked in creating an evolving synergistic joint and combined military capability.

Through a public-private partnership in shaping requirements, the U.S. Government then lets a contract for constructing the system-of-systems approach to be used in a particular military or national security domain. Presumably, the contractor, which has worked with the Government in developing the overall systems architecture, is well positioned to play the role of executing the system-of-systems approach. Clearly, profitability for the firm is limited in building the architecture and is enhanced in the second phase in which it manages the systems architecture.

Within a system-of-systems approach, a number of firms work with the prime contractor and the Federal Government to provide systems and subsystems elements and components. Rather than simply providing parts, the systems and subsystems providers are participating in the execution of the systems architecture and shaping the real-world performance of the system-of-systems capability for combat, military, or national security systems.

Finally, there are component suppliers to the prime contractor and to systems and subsystems providers. In other words, the classic division of defense industry into tiers is being modified to reflect a new division of labor. At the top level are the firms that work with the Government in a public-private partnership to create systems architectures. These primes are then able to execute and manage a system-of-systems capability for the Government. At the next level are those firms that provide (through business units of the primes or by separate commercial or military firms) system and subsystem capabilities within the system of systems. Lastly, there are the component suppliers that work with primes and nonprimes alike in executing the system-of-systems business plan.

In effect, a new pattern of five relationships has emerged in the wake of the consolidation process. (1) The DOD procurement process focuses upon defining the new capabilities that the Department wants so that it can meet transformation requirements. (2) DOD does this in interaction with the market. (3) In turn, the market supports defense firms that have predictable and steady streams of revenue from the Federal Government, and the mega-primes have the flexibility to move within and among programs to provide for financial stability. (4) LSI and system of systems managers work with the Government to establish the range of choices in the marketplace to provide the systems, subsystems, and components available to meet architectural or overall systems requirements. (5) New mission capabilities thus emerge from the interaction between the private sector and the DOD procurement system to provide for the needs of a new Pentagon in its transformation quest.

To elaborate the basic characteristics of the new defense industrial model further, three cases of the emergence of the new capabilities-based approach to procurement will be briefly examined. The first case is the adoption of the Deepwater approach by the Coast Guard, which was forged before the DOD transformation effort but anticipated much of this effort. The second case is the future combat systems (FCS) approach to land warfare. The third case is the Joint Strike Fighter (JSF) and its role with allies in the system-of-systems management model.

Deepwater and USCG Transformation

Even before transformation was a key theme for the new relationship between Government and industry, the U.S. Coast Guard (USCG) was working on its own solution. As the USCG faced block

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The Top 10 Defense Firms Worldwide

Company	2001 Defense Revenue (Millions of US $)
Lockheed Martin	22,502.0
Boeing	19,000.0
BAE SYSTEMS, plc	14,491.8
Raytheon	11,969.0
Northrop Grumman	9,337.5
General Dynamics	7,784.0
Thales Group	5,581.8
EADS, NV	5,504.6
TRW	5,200.0
Rosoboronexport	4,200.0

Source: Defense News, November 11–17, 2002

obsolescence of its core maritime and air assets, the decision was made to pursue a mission-based acquisition approach, which was built around an integrated approach to procurement. As written in *Naval Engineers Journal,*

> Rather than focusing on specific hardware, like a class of cutter or aircraft, the Coast Guard has developed a performance specification that describes the fundamental capabilities the service needs to perform all of its missions in the deepwater regions worldwide.[3]

The USCG sought to take a wide look at its needs in relationship to its missions. Performance-based acquisition was the result: define requirements in light of mission needs and provide systems to meet those needs. No longer would there be one-to-one platform replacements; there would now be decisions made on putting systems in place to provide the capabilities that the USCG would need. The Integrated Deepwater System (IDS) is the designation for this approach to system-of-systems management. At the heart of the IDS effort is an approach to industry relationships. The Coast Guard competed the contract among three teams, each playing the role of an LSI in further defining how the USCG might most effectively put its system-of-systems approach together.

The Coast Guard sought a public-private partnership, which could allow LSI to assist the USCG in getting past the near-term procurement requirements to consider long-term mission and capabilities requirements. How best to provide for the integration of assets in meeting evolving challenges?

With the signature of the Deepwater contract in June 2002, the new industrial relationship with the Coast Guard has been set in motion. The Integrated Coast Guard Systems Joint Venture between Lockheed Martin and Northrop Grumman is the prime for the Deepwater contract working in partnership with the USCG Program Executive Office for Deepwater. Now the task is to provide for a system-of-systems management approach.

The challenge is to mix and match different elements in the Coast Guard universe of platforms, systems, and responsibilities. Integration is often about products; a system-of-systems management approach is about delivering capabilities. Rather than being captured by a single-user community, the new management approach allows one to take a big-picture approach to how capabilities might be provided to meet evolving challenges best. If fewer helicopters are required than fixed wings, if more cutters are necessary than aviation assets, or if an unmanned aerial vehicle (UAV) would best serve the task in a given area, there will be an ability to weigh such choices. The Pentagon is seeking to do what the USCG is positioning itself to do with IDS—that is, to be able to trade among platforms and integration options. This is the integration implied by Deepwater.

Systems integration is different from system-of-systems management. With systems integration, the focus is on a product and the mastery of the development and delivery of an integrated product (for example, building a good fighter aircraft or a good ship is about starting with a platform and integrating more effective systems into it). System-of-systems management is not product-focused; instead, it is capability-focused. What capabilities does the client need? What products—platforms or systems—are available in the global marketplace to provide for those capabilities best? Moreover, how might those products or systems best be meshed to provide for capabilities current and future? It is crucial to this approach to look forward, as well as back, to anticipate change rather than simply respond to past approaches to meeting needs.

This is a different type of business organization and a radically different approach for the Federal Government to work with industry. On the business side, the systems manager pursues an open business model in the development of the core partnerships necessary to provide for Coast Guard needs. On the Government side, it is crucial to be able to make decisions and to identify and communicate mission requirements and needs. There also must be commitment and stability on the Government side.

The post-September 11 challenge has elevated the significance of the Coast Guard in the defense of the Nation and its security interests—and, with it, the new procurement approach. The dramatically enhanced importance of port and maritime security to the survival of the Nation has underscored the salience of the role of the Coast Guard and the need for it to have an approach that allows it to meet this role much more effectively. Prior to September 11, IDS was about service approach to procurement; since September 11, it has been an innovative approach to national survival.

President George W. Bush's creation of the Department of Homeland Security (DHS) has underscored the importance of the USCG decision to pursue IDS. At the core of the DHS mission is the ability to enhance maritime and port security and to provide for an integrated data fusion for all participants in the homeland security process. As President Bush stated:

> The Department would fuse and analyze intelligence and other information pertaining to threats to the homeland from multiple

New Defense Industrial Model

- System-of-systems managers and strategic enablers
- Capability providers for effects-based operations and participants in evolving system-of-systems architectures
- Component providers operating as a global supply base

> sources. . . . The Department would merge under one roof the capability to identify and assess current and future threats to the homeland, map those threats against our current vulnerabilities, issue timely warnings and immediately take or effect appropriate preventive and protective action.[4]

The IDS approach fits right in to the Presidential demand for interoperability of communications and data sharing within DHS. IDS is network-centric, not platform-based. A new commercial off-the-shelf and Navy-compliant command, control, communications, computers, intelligence, surveillance, and reconnaissance (C^4ISR) system that nets the various assets of the Coast Guard to increase maritime domain awareness dramatically is at the heart of the system of systems. As Bruce Stubbs and Scott Truver have argued, "the Coast Guard's leadership role in addressing current and emerging transnational maritime security threats will require seamless C^4ISR connectivity with not only its own operating forces, but those of myriad governmental agencies and nations allied with the United States in confronting those threats."[5]

President Bush has argued for a proactive approach to dealing with the threat of terrorism: "Homeland defense and missile defense are part of a stronger security. They're essential priorities for America. Yet the war on terror will not be won on the defensive. We must take the battle to the enemy, disrupt his plans and confront the worst threats before they emerge."[6]

The IDS approach will allow such a proactive approach. According to the USCG Deepwater Web site,

> By identifying and eliminating threats well before they reach our shores, the impact can be mitigated. Deepwater is critical to ensuring the Coast Guard has the capabilities it needs to stop threats to our homeland before they arrive and the effective response capability to deal with maritime security needs.[7]

The formation of a new Department of Homeland Security will better enable the USCG to play this role.

Consider this scenario: If the Coast Guard stops a ship at sea for inspection and finds illegal immigrants on it, the USCG relies on the Immigration and Naturalization Service to enforce U.S. immigration law and to prevent entry. If the Coast Guard finds potentially dangerous cargo, it relies on the Customs Service to seize it. However, these organizations may not always share information as rapidly as necessary. So instead of arresting potential terrorists and seizing dangerous cargo at sea, our current structure can allow these terrorists to enter our ports and thus the Nation at large. The system might also allow the dangerous cargo to enter our ports and threaten American lives. Under the President's proposal, the ship, the potentially dangerous people, and the dangerous cargo would be seized, at sea, by one department—a department that has no question about either its mission or its authority—to prevent them from reaching our shores.[8]

In other words, the IDS approach was forged well before September 11 and the emergence of any real national debate about the connection between domestic and global security. The data fusion requirements of homeland security are at the heart of the IDS system. A new approach to procurement to mix and match assets to meet missions and the national security challenge is also a major contribution of USCG thinking to future national security.

Army Transformation, FCS, and LSI

The key test of transformation is what happens with land power. How much innovation can be generated quickly and effectively in getting the future capabilities of a global force into deployed capabilities? How much integration with other aspects of joint and combined power can be enhanced by the new approaches? How much authority will land forces have in directing other elements of joint power in operating on a global basis to ensure effective military operations?

Before the Bush administration, Army leadership had already crafted a transformation plan. The planned Army transition has been from the legacy force (heavy and slow) to an interim force (light and deployable) to the Objective Force 21 by 2030, which will be flexible, agile, integrated, and sustainable. The legacy force is built around heavy armor (60–70 tons, 650 cubic feet, and carried by a C–5 or C–17 strategic airlift aircraft) to new armor (20 tons, 300 cubic feet, and capable of being carried by a C–130). The Objective Force will be able to be integrated into either the air-based or sea-based force approach, although maximum operational flexibility seems to be linked to innovations in joint and combined basing at sea.

The new Army would be able to operate within a system-of-systems context and to provide for the global striking power necessary for a new expeditionary model. The Bush administration has sought to accelerate the development of the Objective Force at the expense of modernization or pipeline equipment upgrades in the legacy force. The administration has also questioned whether the interim force should not be altered to put in place elements of the future combat systems (FCS) much earlier than envisaged prior to the defense buildup after September 11.

For example, the Bush administration decision to cancel the Crusader artillery system was rooted in its inability to move quickly into theater operations. It was judged too big and its logistics tail too long to be sustained for rapid, flexible operations. At the same time, the administration has supported FCS, a new Army and Defense Advanced Research Projects Agency (DARPA) initiative that is to provide networked ground strike forces able to be inserted rapidly and with both strategic and operational flexibility.

The Objective Force and its core systems development program—FCS—are at the center of developing an architectural roadmap for the role of land power integrated within the ground-to-air evolution. The Army adopted the USCG Deepwater model as a baseline to provide a capabilities-based approach to its future needs to operate globally. The goal of the FCS program is to develop network-centric concepts for a multimission combat system that will be overwhelmingly lethal, strategically deployable, self-sustaining, and highly survivable in combat through the use of an ensemble of manned and unmanned ground and air platforms.

This system-of-systems design is being crafted by using modeling and simulation and experimentation to evaluate competitive concepts. The FCS will be capable of adjusting to a changing set of missions, ranging from warfighting to peacekeeping. An FCS-equipped force will be capable of providing mobile-networked C^4 functionalities; autonomous robotic systems; precision direct and indirect fires; airborne and ground organic sensor platforms; precision, three-dimensional air defense; and nonlethal and adverse-weather reconnaissance, surveillance, targeting, and acquisition.

The U.S. Army LSI contract awarded to the team of Boeing Space and Communications and Science Applications International Corporation was granted with an eye to increasing the speed of realizing a future Objective Force with FCS by 2010. COL William Johnson (program manager and FCS and Army project manager for Objective Force) recently noted that the Boeing role is to bring all of the systems together so that they will be interoperable. The architecture focuses on informing the soldiers and synchronizing the entire Army around the Objective Force.[9]

The logic behind giving the LSI role to a space company (Boeing) is rooted in the key role that space and related information systems will have for the future of the Army as a global force. The Army decided that it needed a team that was capable of a system-centric and not a platform-centric approach, one based on an integrated C^{4}ISR architecture.

The FCS program is not following the classic sequential development path to acquisition. Rather, the development of various aspects of a mature FCS system is envisaged and pursued in parallel. The most mature aspects of development will enter the force earlier than others but in line with an evolving open architecture of developing technologies in the system-of-systems environment.

The core LSI responsibility is managing the parallel development process. According to LTG John Riggs, director of the Objective Force Task Force for the Army,

> The LSI is definitely involved in every aspect of this program and I think it's paying off. They're involved in assisting with requirements-development activities; they're involved in the architecture of the work; they're involved in the integration work that is associated with formulating an acquisition strategy—just about every aspect of it in this particular phase.[10]

Riggs went on to argue that the core benefit of the LSI arrangement was that an ability to leap to future capabilities is greatly facilitated. "But from my perspective," Riggs stated, "the LSI arrangement has greatly assisted us in cutting years—not months, years—off what would normally be expected in this phase of a major equipment program."[11]

The LSI is responsible for a number of key aspects in FCS development, including awarding contracts to system, subsystem, and component providers for the development of specific technologies and concepts. By June 2003, the LSI must provide the DARPA–Army client with an initial system-of-systems architecture, C^{4}ISR architecture, and platform architecture.[12]

In short, rather than building a set of stovepiped products, the prime contractors for the future combat systems are orchestrating the development of a set of capabilities for the U.S. Army. There is an opportunity as well to enhance their European partnerships—a major German firm is already involved—to blend a C^4 and ISR approach to ground combat with European ground systems as well. Rather than selling a product, the U.S. companies with U.S. and European government cooperation could develop capabilities for allied forces.

Joint Strike Fighter

The JSF program, managed jointly by the U.S. Air Force and the Department of the Navy, represents the most mature transformation program for the development of new U.S. combat capabilities. The JSF system is interservice in character. It is designed to build joint rather than separate service systems capabilities. It spans three administrations and represents a commitment to change in providing a global capacity for the U.S. military with simplified logistics, weaponization, and worldwide interoperability with key allies.

The JSF program has instituted a new approach to international procurement. The program is modeled in part after the Airbus approach to building commercial aircraft. There is a single production line, but participants in the program build subsections for the entire global buy of JSF, which are then flown to Fort Worth, Texas, for final assembly. Commercial approaches to logistics are an important part of the JSF model that explains in part the agreement between Fort Worth and Airbus on logistics issues.

Boeing and Lockheed Martin competed to provide the architecture for the JSF combat system for the U.S. Government. Now that Lockheed has won the JSF contract, it is working closely with the Government to establish a system-of-systems management approach for the launch of the JSF system. The participants in the JSF program provide systems, subsystems, and components in a radically different approach from the F–16 or F–18 model. Historically, subcontractors provided parts; in JSF, partners provide systems and subsystems.

The international approach revolves around participation at different levels of partnership, ranging from level one to level three partnerships; levels depend on the amount of investment and involvement through technology sharing and government-to-government agreements.[13]

Industrial participation is not through industrial offsets but participation within a global production run of the program. For example, rather than the Dutch simply producing parts for their JSF, Dutch industry participating in JSF will produce system or subsystem components for the entire global production run of the Joint Strike Fighter, regardless of production specifically for the United States or another country. Such an approach is much more akin to a commercial effort than a classic military aircraft production approach and thus more like the Airbus model than the classic F–16 approach.

The JSF production model is in many ways the testbed of change in the role of industry in leading transformation. If technology sharing can be framed by multinational licensing and a new relationship between the U.S. prime and its systems and subsystems providers, a new type of Airbus model can be introduced in the military air combat domain.

The JSF is designed to operate as a provider of missions in an integrated battlespace. The shift is from providing a pure platform to becoming a full-spectrum provider—one that is customer-driven and able to provide air combat capabilities, ranging from future new aircraft to full-service field maintenance.

This concept rests in part on the ability to leverage the commercial and global markets in order to be able to provide the best customer solution at the most affordable price. Specific to the JSF, the objective is to provide tailored customer solutions, teaming with the global customer, suppliers, and partners.

Using this emerging business model, the defense industry—like its commercial counterparts began doing almost a decade ago—will have to be more involved in maintaining the products they build. Increasingly, military acquisition policy is focusing on total ownership cost. Bundling of a product's total life cycle is far more cost-efficient

and less expensive than acquiring the product and then seeking to support it throughout its life cycle with a series of one-off contracts. This new model seeks to provide integrated combat missions to global customers with government/industry teams providing cradle-to-grave support for military aircraft and related air combat systems.

But for the JSF model to fulfill its promise, the logistics, information technology, and weaponization capabilities associated with the model will have to become truly global, which means conducting overseas operations and support with allies playing key roles in operations as well as production and maintenance. Thus, the Italians, after making their commitment to JSF, have argued for a European JSF support center. Certainly, the leading European missile firm, MBDA, will be in a position to weaponize JSFs for European as well as American use. It would be advantageous for the United States to have alternative sources of supply for weapons in combat situations where European suppliers are closer at hand than American ones.

The Allied Dimension

The new defense industrial model is generating opportunities for cooperation and an ability to provide for enhanced allied capabilities. At the systems architecture development or system-of-systems management level, it is difficult to see anything but a national U.S. or European approach. But with regard to systems and subsystems capabilities plugging into architectures and system-of-systems approaches, European, Asian, and American firms could contribute equally to American or allied capabilities.

The new primes in Europe—notably, EADS, BAES, and Thales—can provide an ability to shape a European architecture or system-of-systems approach for European allies. System or subsystems capabilities, which might contribute to either U.S. or European architectures, would enhance the ability of inter- and intra-allied operations. Interactive military transformation would be the result.

The key challenge for allied governments is to shape policies that allow the major companies to work with one another to provide capabilities available to allies. By allowing the small number of primes on both sides of the Atlantic to pursue goals to meet common needs, transformation could be promoted. The old export model of taking 20 years to develop a product and then compete in the marketplace serves neither American nor European interests. Nurturing multiple partnerships among the Euro-Atlantic primes can create new technologies and opportunities for change.

Developing an innovative relationship between industry and government and fostering greater European capacity to leverage a transatlantic defense market are key tools for driving change within European defense and promoting inter-allied transformation. As Gordon Adams recently argued,

> Prague has opened a new door to a transformed alliance. But the ambitious goals set out at the summit will be doomed to failure without major steps in the U.S. trade regime that will make trans-Atlantic industrial and technological cooperation possible.[14]

Several examples further illustrate the changes under way. UAVs have become a key focal point for DOD thinking about transformation opportunities after the initial Afghan operation. Drawdown in manned systems, a better use of ISR, and integration of space, air, and ground capabilities are on offer from the rapid development of UAVs and then unmanned combat aerial vehicles (UCAVs).

Notably, the United Kingdom has focused on the Watchkeeper UAV program as a key part of its integrated combat system of the future. At the core of the Watchkeeper program will be the formation of a network warfare solution, and, almost certainly, U.S. firms such as Northrop Grumman, General Atomics, or Lockheed Martin will be involved in the Ministry of Defense solution.

The aim is to focus attention on binding the systems together—as well as integrating them within the developing British information, surveillance target acquisition, and reconnaissance (ISTAR) system-of-systems network—using the expertise of the group as the glue. The system must be able to interface seamlessly with Bowman, the new British digital communications network, the Royal Air Force (RAF) airborne stand-off radar (ASTOR), and other ISTAR systems. The data generated by Watchkeeper must ultimately be disseminated to shooters such as RAF (or coalition) aircraft operating in the close air support role, the WAH–64D Longbow attack helicopter, and artillery units.[15]

To promote inter-allied capabilities on unmanned systems further, the United States and the United Kingdom have recently signed an agreement to share technologies. Notably, the agreement will allow the United Kingdom to have access to developing technologies for the Boeing X–45 UCAV program.[16]

Also, the Northrop Grumman and EADS agreement to develop a Eurohawk variant of Globalhawk provides an opportunity to build up the number of UAVs available to U.S. and allied forces and to allow Europeans as well as Americans to develop their own modular packages within the common UAV bus. Joint capabilities can clearly emerge from this, and without common buses, the U.S. goal of having a global sensor system to detect various ballistic and cruise missile worldwide would be even more complicated.

An especially compelling case of the advantages of blended programs for military transformation has been the IZAR–Bath–LMC partnership to build Aegis frigates. This effort began with a competition to build the F–100 Spanish Aegis frigate. The partnership then allowed the team to bid for the Norwegian frigate program and to create a smaller platform, which also will carry Aegis. This will lead to at least nine Aegis frigates emerging from Europe, which will certainly prove useful to Euro-Atlantic naval and aerospace operations. Now that IZAR has led the way to build an even smaller 2,500-ton frigate, which is Aegis-capable and available for export, the main opportunities might come in the Asia-Pacific region. When one adds the new frigate populating selected Asian allied navies with the Japanese Aegis programs, the benefits to the United States as well as allies are obvious.

Global missile defense is another example of a transformation area in which blended programs can become significant. The medium extended air defense system (MEADS) program among the United States, Germany, and Italy will be part of the shooter network. Aegis upgrades and inclusion in the global sensor network will be important as well.

But the overall effort to develop ballistic missile defense C^3 is an area in which blended systems could become significant indeed. There is a need for ground-, air-, and space-based sensors networked to provide regional and global convergence against ballistic, air, and cruise missile threats. With the formation of an open battle management,

command, control, and communications (BMC^3) architecture, the U.S. Government would be in the position to work with allied governments to allow the key U.S. and European primes to develop and network their systems to provide for national, European, American, and global sensor capabilities.

Boeing recently has signed agreements with EADS, BAES, and Alenia to pursue the possibility of developing common capabilities in the global missile defense area. EADS and Boeing have capabilities in both the sensor and launcher areas of interest to build a global missile defense system. BAES is one of the world's leading companies in ISR capabilities, and its strong presence in both Europe and the United States makes it an ideal partner for pursuing strong transatlantic missile defense efforts.

James Albaugh, president and chief executive officer of the newly formed Boeing Integrated Defense Systems unit, commented on the Alenia agreement:

> Boeing is the prime on integrated missile defense. We have established the MOU [memorandum of understanding] that provides an open framework for industrial cooperation. The intent is to establish long-term relationships between Boeing and Alenia Spazio in global missile defense.[17]

By promoting industrial cooperation in the wake of the termination of the Antiballistic Missile (ABM) Treaty, Washington seeks to promote global missile defense capabilities. According to *The Washington Times*, "U.S. officials have said that the participation of allies in creating a missile-defense system could extend its range, defray some costs and allow the United States to test and deploy sensors, radar or missile interceptors closer to enemy countries."[18]

Among the most vocal of these officials has been David Martin, Missile Defense Agency (MDA) deputy for strategic relations. Martin has underscored the significance of the new opportunities opened by the end of the ABM Treaty for U.S.-allied cooperation, and not only with Europeans. MDA also is pursuing work with Israel, Russia, and Japan.[19]

The new industrial model also means that Europe can pursue its systems architecture and system-of-systems approach where it meets its needs rather than simply following American leads. Then partnership among primes in shaping participation of system and subsystem suppliers can allow for the emergence of greater Euro-Atlantic capabilities.

For example, if Europe goes ahead with the A400M airlifter, it could pursue a variant of the approach of General John Jumper, U.S. Air Force chief of staff, which is to build smart capabilities into lifters and tankers. Here Europeans would build common C^2 and other network systems on the lifters that would allow them to work together in joint interventions.

The controversial Galileo system is an example of Europe trying to build a common architecture, which could involve American participation at the system and subsystem levels. Perhaps the only way the United States might avoid Galileo would be the engagement of Europe as a key stakeholder at the global positioning system (GPS) table, something that was envisaged in the GPS II process.

The European Union and the European Space Agency (ESA) have jointly launched the development and validation phase for their global competitor to the American GPS system. On March 26, 2002, the European Transport Council approved its part of the joint funding, so the new phase is under way. This is the first time that the European Union and ESA have worked together, and the cooperation represents a key management test of joining these two public entities. At the same time, a common program management office, which will include the private sector, is being launched.

Many space companies across the European Union see great economic potential from the program, ranging from building hundreds of components for the 30-satellite constellation to providing ground equipment and services down the Galileo value chain.

For Europeans, the launching of Galileo will allow them independence from the United States. European space and telecommunications industries will receive a much-needed boost in a time of economic downturn; and for the first time, the space industry will be able to tap European transport infrastructure funds.

In short, the new defense industrial model in Europe and the United States means that a small number of consolidated primes will be the gatekeepers for Europe in building architectures and system-of-systems management approaches. Global relationships between U.S. and European primes can frame ways to enhance inter-allied capabilities as America pursues its transformation approach. The United States will then be able to implement its new global military model more effectively as well.

Conclusion

The system-of-systems approach is at the core of the U.S. Government approach to transformation. The effort to get beyond support for discrete systems in the pipeline—to examine comprehensively where one wants to be in future joint operations and to work backwards—is crucial for the transformation effort. Having mega-primes aligned with this vision and, in fact, directing a strategic redesign of military and security capabilities are key aspects of a successful transformation strategy.

For this to work, the relationship between the mega-primes and the Government needs to become more effective. Industry needs to play its leadership role in sorting out the range of possible technical and organizational choices that best serve a system-of-systems approach; the Federal Government needs to provide guidance on where it wants to go in this process and to generate support for innovation.

Sponsoring innovation will occur in several ways: Government research and development (R&D) provided in laboratories are key parts of the equation for innovation. Defining the relationship between the LSIs and the laboratories will be a main challenge for the Government. Sponsoring black-box innovation, via DARPA and similar agencies, is important as well. But what will the relationship be between the limited profit made on Federal Government black-box R&D and the prospects for much greater profit on series production items?

In other words, how does one avoid vertical integration practices of the large firms, which squelch innovation, and yet use the LSIs to work with small and mid-size firms essential for innovation? How does the Government define profit structures for the relationships between the LSIs and system-of-systems managers and the

system, subsystem, and component suppliers and the R&D drivers to the process of innovation?

Pierre Chao of Credit Suisse has underscored the tensions between the U.S. Government and industry in trying to make the LSI model work:

> There are two major obstacles to getting a defense industrial base capable of meeting the Pentagon's transformation goals. The first is cultural. The new system-of-systems and Lead Systems Integrator approach to defense contracting hinges on one critical element . . . the ability for the industry and the Department of Defense to work as partners. This, however, flies in the face of decades of conditioning that prizes maintaining an adversarial relationship with industry and a media that is looking for any signs of the insidious military-industrial complex that Eisenhower supposedly warned us about. The second set of obstacles are the laws, rules, and regulations in place that make it difficult to create a true partnership with industry.[20]

Defining pathways for commercial firms to provide technologies of increasing value to the Federal Government is another issue for transformation. Here, the United States could seek to deal with commercial firms, which have limited interest in dealing with the Government as a customer, or to find ways to use the larger firms as gatekeepers for commercial firms to provide the systems or subsystems relevant to system-of-systems management. The challenge is not only to recognize that large firms are necessary to play LSI roles but also to ensure that competitive processes are generated within the system-of-systems management effort.

Above all, the new defense industrial model contains elements of its own dynamics for further change. As Byran Callan of Merrill Lynch and his colleagues have put it, long-term defense industrial restructuring is probable as DOD seeks to deal with consolidation and innovation challenges. First, DOD will seek to enhance competition and innovation by engaging small to medium-sized defense firms and seeking to attract commercial information and electronics firms. Secondly, global systems models could devolve as "companies will probably need to concentrate on systems engineering or focus more on dominating particularly product and system markets."[21]

In short, we have already crossed the Rubicon. Even with the augmented U.S. defense and national security budget after September 11, there is only enough money to support a small number of defense primes in interaction with a global systems and supply base. At the same time, these primes and the systems and subsystems suppliers will provide the means through which transformation will be executed.

Transformation will be generated through a new defense industrial model, which is built around public-private partnerships in creating systems architectures, managing system-of-systems approaches, and working with U.S. and allied systems and subsystems providers.

The transformation process emphasizes joint as well as combined military capabilities pursuing network solutions. Industry is crucial to frame ways for the United States and its allies to anchor a transformation process. Any serious treatment of military transformation must consider how industry leads, interacts with, and supports this process.

Notes

[1] *Fusion* is the ability to link intelligence and surveillance sensors and combine their products into a single battlefield picture.

[2] Donald H. Rumsfeld, memorandum to the Chairman of the Joint Chiefs of Staff, October 22, 2002: "Options should include, but not be limited to, (a) creation of an agency which would address, fund, and implement aspects of battle management and control [sic] (BMC^2) interoperability and connectivity; and (b) allocation of money directly to all Combatant Commanders to buy 'joint' BMC^2 systems; and (c) authority and allocation of money directly to JFCOM to buy 'joint' BMC^2 systems to support combatant commanders." Quoted in David A. Fulghum, "Rumsfeld Pushes Network Warfare," *Aviation Week and Space Technology* 157, no. 20 (November 11, 2002), 32–33.

[3] Michael Anderson, Diane Burton, M. Steven Palmquist, and J. Michael Watson, "The Deepwater Project—A Sea Change for the U.S. Coast Guard," *Naval Engineers Journal* 111, no. 3 (May 1999), 125–131.

[4] George W. Bush, The Department of Homeland Security (June 2002), 3.

[5] Bruce Stubbs and Scott C. Truver, *America's Coast Guard: Safeguarding U.S. Maritime Safety and Security in the 21st Century* (Washington, DC: United States Coast Guard, 1999), 107.

[6] George W. Bush, commencement address, United States Military Academy at West Point, June 1, 2002.

[7] United States Coast Guard, Integrated Deepwater System Program: Maritime Domain Awareness, accessed at <http://www.uscg.mil/deepwater/>.

[8] Bush, Department of Homeland Security, 5.

[9] Stuart McCutchen, "Army Says 'Lead Systems Integrator' Approach Will Expedite FCS Implementation," Infobase Web site (March 13, 2002).

[10] John G. Roos, "Army Transformation: Objective Force Vision Encompasses Much More than Hardware," *Armed Forces Journal International*, October 2002, 38–44.

[11] Ibid., 42.

[12] For a good treatment of the lead systems integrators in relationship to the future combat system, see Daniel Gouré, "The Army's FCS Gamble: Robots Could Outnumber Soldiers in the Service's Planned Future Combat Systems," *Armed Forces Journal International*, October 2002, 46–54.

[13] "F–35: The Business Strategy," *Jane's Defence Weekly*, July 24, 2002.

[14] Gordon Adams, "Aftermath of Prague: New Strategy Hinges on U.S. Defense Trade Reform," *Defense News*, December 16, 2002, 17.

[15] Nick Cook, "Watchkeeper Contest Set for a Showdown," *Interavia* 57, no. 665 (July-August 2002), 30–32.

[16] Andrew Chuter, "U.K., U.S. to Share UAV Technology," *Defense News*, December 9–15, 2002, 1, 8.

[17] "Boeing and Alenia Announce Transatlantic Partnership for Missile Defense," *Business Wire*, July 23, 2002.

[18] "Boeing Inks Pact with Three Firms in Europe," *The Washington Times*, July 24, 2002.

[19] Kerry Gildea, "U.S. Japan Review Options for Future Sea-based Missile Defense Work," *Defense Daily International*, July 12, 2002.

[20] Personal communication with author, November 18, 2002.

[21] Merrill Lynch, *Defense and Aerospace* (June 27, 2002).

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